Christian Medical and Dental Associations
Guideline for Church Reopening During the SARS-CoV-2/COVID-19 Pandemic
July 2020

Part of the mission of CMDA is to glorify God by caring for all people and advancing Biblical principles of healthcare within the Church and throughout the world. With that in mind, CMDA has enlisted several expert members to provide guidance to church leaders as they wrestle with the problem of re-opening their services within the ongoing COVID-19 pandemic.

Statement of the Problem

Religious involvement correlates with the following health benefits through various pathways (1):

1. Decreased overall mortality (2)
2. Improved outcomes with chronic conditions such as diabetes (3)
3. Increased ability to cope with stress (4)
4. Decreased depression, suicide, and anxiety (4)
5. Some evidence of decreased blood pressure (5)
6. This has been shown to be especially true for vulnerable sub-groups in the African American community (6)

However, attendance at religious services has been labeled "high risk" for SARS-CoV-2/COVID-19 exposure due to "enclosed space, prolonged close contact/potential clustering of people, high-touch surfaces, singing/projection of voice" (7). Thus, many congregations in the United States have gone through a period of being unable to meet because of state restrictions. Unfortunately, churches have had to weigh the risks of reopening with the benefits of gathering in person not only without clear consensus guidelines but rather with conflicting guidelines from state to state and even within states from one agency to another.

Thus, the purpose of these guidelines is to provide evidence-based recommendations for Christian communities who wish to reopen safely. Though evidence-based, however, these guidelines are not intended to replace government ordinances or health regulations and should be considered in light of local guidance which account for the community prevalence of SARS-CoV-2/COVID-19 and available resources.

Evidence and Strength of Each Recommendation

Classification of Evidence:

Class I – Randomized trial with adequate statistical power, appropriately designed experimental studies, or systematic reviews of randomized trials +/- meta-analysis

Class II – Randomized trials with incomplete data/enrollment or poor controls, prospective cohort studies, quasi-experimental studies, systematic reviews of a combination of randomized trials and quasi-experimental studies +/- meta-analysis

Class III – Retrospective studies, case-control studies, qualitative studies and reviews

Class IV – Case Series, non-peer-reviewed studies, expert opinion/consensus

Strength of Recommendations

Level A Recommendations – Recommendations with a high degree of certainty based on Class I evidence or multiple Class II evidence

Level B Recommendations – Recommendations with moderate certainty based on Class I evidence, Class II evidence, or strong consensus of Class III evidence

Level C Recommendations – Recommendations with less certainty based on Class III/IV evidence or, in the absence of adequate evidence, based on expert consensus

Critical Question 1: How many people can safely gather in a given area for worship services?
Guideline Recommendations

Level A Recommendation: none

Level B Recommendation: none

Level C Recommendation: Worship services that have a large number of participants, unmasked, in close proximity to one another for a prolonged period of time in an enclosed space without hand sanitizer or hygiene measures increase the risk of spreading SARS-CoV-2/COVID-19 infection if one of the participants has SARS-CoV-2/COVID-19. Therefore, the number of people that could gather safely for worship should be determined by the type of space (enclosed or open-air), size of meeting area, and safety measures enacted. Such gatherings should avoid having a large number of participants, unmasked, in close proximity to one another for a prolonged period of time in an enclosed space without hand sanitizer or hygiene measures.

Hebrews 10:24,25 admonishes, "And let us consider how we may spur one another on toward love and good deeds, not giving up meeting together, as some are in the habit of doing, but encouraging one another—and all the more as you see the Day approaching." Throughout the Bible, the Lord instructed His people to gather in worship to praise His holy name and congregational, communal worship has been a foundational practice of the church ever since its establishment on the Day of Pentecost. Due to the recent SARS-CoV-2/COVID-19 pandemic, however, churches in different regions have been unable to meet safely and there has been uncertainty regarding how many people can gather safely in a given area for worship.

Evidence: No Class I, II, or III evidence is available, but at least nine clusters of cases related to church attendance and SARS-CoV-2/COVID-19 infection have been reported (Class IV evidence). The literature for this review was retrieved from a database search which included Medline,

PubMed, Google Scholar, Google, CEBM, Cochrane Library, Oxford CEBM, CDC, NICE, NIH, and Medrixiv Preprints using the terms “church” and “COVID” or “SARS” or “coronavirus.”

Two case series reported significant spread of SARS-CoV-2/COVID-19 infection when a large number of worshippers were together daily for prolonged periods of time without masks, distancing, or hygiene measures in an enclosed space over a week (8-10). In Mulhouse, France, 1,000-2,5000 worshippers were together without masks, distancing, or hand sanitizer for hours each day for one week. It is believed that ill worshippers seeking healing spread SARS-CoV-2/COVID-19 to a total of 2,500 people, although it is unknown if any of those people were also exposed elsewhere in the community or their countries of origin. In Daegu, South Korea, hundreds of worshippers were together daily without masks, distancing, or hand sanitizer in an enclosed space for hours each day. It is believed that one person with SARS-CoV-2/COVID-19 spread the infection to at least 37 other worshippers over 4 days and a total of 4,482 cases were traced to members of the church, although it is unknown if any of those people were also exposed elsewhere in the community. Given the unique situation of both of these case series—namely, a large number of worshippers were together daily for a prolonged period of time without masks, distancing, or hygiene measures in an enclosed space with worshippers who were ill—care should be taken in drawing conclusions based on these cases for worship gatherings with completely different characteristics.

Two case series were reported from Singapore with significantly less spread of SARS-CoV-2/COVID-19 infection. In the first series, two Chinese nationals from Wuhan, China, attended a church service for 2 hours without mask, social distance, or hand hygiene, and then three others subsequently tested positive for SARS-CoV-2/COVID-19, one of whom sat in the same seat as the couple from Wuhan for the prayer meeting after the morning service (11). In the second series, a couple from Wuhan, China, attended a church service and presumably spread SARS-CoV-2/COVID-19 to two people in attendance who then spread SARS-CoV-2/COVID-19 to close contacts and family members at a Lunar New Year’s party involving a large number of people unmasked in an enclosed space for a prolonged period of time eating common food (12). There was subsequent involvement in church services by an ill individual where congregants sat in close proximity without masks for a prolonged period of time in an enclosed space. In total, 28 people were infected with SARS-CoV-2/COVID-19.

Several clusters have been reported in the United States. In the Arkansas cluster, a church in rural Arkansas hosted a 3-day children’s event with over 5 hours of indoor sessions with hand-to-hand contact, close contact among participants (e.g., shaking of hands and hugging), and sharing common food from March 6-8, 2020, where two participants were ill with symptoms consistent with SARS-CoV-2/COVID-19 infection, followed by a Bible study event on March 11, 2020 (13). In total, at least 35 of the attendees became infected with SARS-CoV-2/COVID-19 and another 26 cases were identified from people who had close contact with one of those attendees. In a cluster from Sacramento County, California, reported details are conflicting and sparse, but it appears that large numbers of church members were meeting together in small homes, having close contact without masks and sharing meals, presumably leading to 70 cases of SARS-CoV-2/COVID-19 infection although it is unknown if any of the cases could have been

infected elsewhere in the community (14). In a cluster from Louisville, Kentucky, a church gathered in Dawson Springs with a large number of participants close together without masks in an enclosed space, then several ill members went to a revival meeting held over two days where large numbers of participants were close together without masks in an enclosed space for multiple prolonged periods of time, leading to at least 30 cases of SARS-CoV-2/COVID-19 infection (15). In the fourth cluster from Union County, Oregon, few details are available but it appears that hundreds of worshippers were close together without masks in an enclosed space, having direct contact with one another for a prolonged period of time, presumably leading to 99 cases of SARS-CoV-2/COVID-19 infection (16).

These additional case series from Singapore and the United States share characteristics with the other two from Mulhouse, France, and Daegu, South Korea, which may not apply to all worship gatherings—namely, large numbers of worshippers were in close physical proximity without masks or hand sanitizer for a prolonged period of time in an enclosed space. Therefore, worship services should mitigate these factors to decrease the risk of SARS-CoV-2/COVID-19 transmission.

Another cluster was reported from Frankfurt, Germany, in a church formed primarily by large families with children. Details are sparse but unlike the other clusters listed above, hygiene protocols were in place and congregants were distanced 5 feet apart, yet over 100 cases of SARS-CoV-2/COVID-19 infection have been traced to its participants (17). Congregants were not required to wear masks, there was extensive congregational singing, and participation in other re-opened activities was not prohibited. It is unknown if anyone attended the service while ill. Although additional recommendations cannot be made based on this cluster due to the lack of details, it highlights the need to proceed cautiously and suggests that a greater distance (possibly 6 feet) plus the use of masks while limiting other activities may be necessary to prevent subsequent SARS-CoV-2/COVID-19 transmission.

Others case reports were identified from the New York Times and other news outlets, but had few details which would allow for additional recommendations to be made and, thus, were not included in this literature review.

Critical Question 2: Is it safe to practice the sacrament of communion?
Guideline Recommendations

Level A Recommendation: none

Level B Recommendation: none

Level C Recommendation: Communion can be safely done using single-serving, pre-packaged communion.

The apostle Paul states, “For I received from the Lord what I also passed on to you: The Lord Jesus, on the night he was betrayed, took bread, and when he had given thanks, he broke it and said, “This is my body, which is for you; do this in remembrance of me.” In the same way, after supper he took the cup, saying, “This cup is the new covenant in my blood; do this, whenever you drink it, in remembrance of me.” For whenever you eat this bread and drink this cup, you

proclaim the Lord's death until he comes." (1 Corinthians 11:23-26). From the earliest of times, the church celebrated communion as a sacred act of worship to remember the sacrifice of Jesus for humanity. Although practiced in different ways in different Christian traditions, it is one of the most common ancient Christian practices, but may be a source for spreading SARS-CoV-2/COVID-19 infection.

Evidence: No Class I or II evidence is available. The literature for this review was retrieved from a database search which included Medline, PubMed, Google Scholar, Google, CEBM, Cochrane Library, Oxford CEBM, CDC, NICE, NIH, and Medrixiv Preprints using the terms "communion" or "eucharist" and "infection" or "COVID" or "SARS" or "coronavirus."

In regard to communion, safety may depend on the mode of communion practiced. There are no case reports of illness or infection due to the use of single-serving, pre-packaged communion, which has been available for many years and meets health guidelines for pre-packaged food preparation. When distributed by those who practice hand hygiene and then wear gloves with appropriate distance from those receiving communion, we believe this poses no additional risk to the participant.

With regards to those traditions that use a common cup, it has been claimed that "just entering the worship space is 'more risky'" (18). However, available Class III/IV evidence as summarized in table 1 suggests that there may be a negligible to small risk of infection associated with using a common communion cup.

Table 1. Class III/IV evidence regarding common communion cup.

Source	Design	Findings
Burrows, Hemmens (19)	Quasi-experimental, non-clinical, no outcome measures	At most, 0.001% of organisms were transferred between users and "small numbers of bacteria" were detected after use by 4 people
Gregory et al (20)	Quasi-experimental, non-clinical, no outcome measures	Multiple bacteria could survive on the chalice
Hobbs, et al (21)	Quasi-experimental, non-clinical, no outcome measures	Organisms on the rim of the cup lived longer than 5 seconds; 90% of organisms were removed by a purifying cloth; recommended using individual cups or intinction
Gill (22)	Non-systematic review	The alcohol content of the wine does not impact transmission and use of a purifying wipe is more

		effective at reducing transmission;
Furlow, Dougherty (23)	Quasi-experimental, non-clinical, no outcome measures	Bacteria was found in communion wine 10 minutes after communion service
Loving (24)	Quasi-experimental, non-clinical, no outcome measures	Intinction appears to be less risky than a common cup but depends on the cleanliness of the minister's hands; 94% of wine samples had no bacterial growth after intinction
Loving, Wolf (25)	Qualitative survey	No difference was found in terms of illness among those who took communion and those who did not
Manangan, et al (26)	Letter to the editor, non-systematic review	"the risk for infectious disease transmission by a common communion cup is very low"
Hulme (27)	"not checked" EBM review	"No evidence exists that sharing a communion cup or intinction have caused infection"

Critical Question 3: Is it safe to practice the sacrament of baptism?
Guideline Recommendations

Level A Recommendation: none

Level B Recommendation: none

Level C Recommendation: Baptism may be safely done with clean water. For serial baptisms in the same baptistry, the baptismal should be heated above 23^{o}C and treated with chlorine to decrease the risk of transmission of SARS-CoV-2/COVID-19. We recommend that the person performing the baptism wear a mask, practice hand hygiene prior to the baptism, and defer to someone else if he/she has any symptoms compatible with SARS-CoV-2/COVID-19 infection.

In Matthew 28:18-20, Jesus says, "All authority in heaven and on earth has been given to me. Therefore, go and make disciples of all nations, baptizing them in the name of the Father and of the Son and of the Holy Spirit, and teaching them to obey everything I have commanded you. And surely I am with you always, to the very end of the age." From the beginning of the church, baptism has been a basic Christian rite, practiced around the world in almost every denomination. Although specific rituals related to baptism vary by denomination, it is a sacred

rite uniting believers to Jesus. However, there has been some concern about transmission of SARS-CoV-2/COVID-19 during baptism.

Evidence: No Class I, II, or III evidence is available. One retrospective cross-sectional study and one case report were found related to baptism and infections, but do not have direct application to baptism as practiced in most Christian communities in the United States. The literature for this review was retrieved from a database search which included Medline, PubMed, Google Scholar, Google, CEBM, Cochrane Library, Oxford CEBM, CDC, NICE, NIH, and Medrixiv Preprints using the terms "baptism" or "baptistry" and "infection" or "COVID" or "SARS" or "coronavirus."

In the retrospective study from Zimbabwe, the authors described some cases of schistosomiasis among school children associated with baptism or bathing in infected water in Zimbabwe (28). The case report was from Japan, describing a case of neonatal Edwardsiella tarda infection following delivery by a woman who had been baptized in a lake (29). Due to the unique circumstances of these cases, they do not apply to most churches practicing baptism in the United States regardless of baptismal mode.

There was also a book chapter on the hot tub for spiritual practice, mentioning folliculitis, Legionnaire's Disease, and Mycobacterium avium as potential risks of regular hot tub use but this was not related to the religious rite of baptism, though it described hot tub use as a "daily baptism (30). This was not considered relevant to the practice of baptism in the United States.

Eight studies were identified that assessed for the risk of SARS-CoV-2/COVID-19 transmission through water (see Table 2). None actually studied waterborne transmission and none directly pertain to baptism. However, they suggest that the virus is unstable in chlorine, is much less stable in water than viruses with known waterborne transmission, and declines rapidly in water > 23^{o}C.

Table 2. Class III/IV evidence regarding coronavirus presence/survival in water

Source	Design	Findings
Ahmed (31)	Quasi-experimental, non-clinical, no outcome measures	SARS-CoV-2 RNA was found in the wastewater in Australia but actual living virus was not studied.
Alexyuk (32)	Quasi-experimental, non-clinical, no outcome measures	Coronaviridae were found in less than 0.01% of detected viral reads in fresh water in Kazakhstan
Bibby, Peccia (33)	Quasi-experimental, non-clinical, no outcome measures	Sewage sludge samples had human coronaviruses, but quickly diminished

Blanco et al (34)	Quasi-experimental, non-clinical, no outcome measures	One sample out of 21 samples from Wadi Hanifa, Riyadh, had alphacoronavirus
Gundy et al (35)	Quasi-experimental, non-clinical, no outcome measures	Human coronavirus was more rapidly reduced by water at 23^{o}C compared to 4^{o}C
Wang et al (36)	Quasi-experimental, non-clinical, no outcome measures	SARS-CoV in wastewater survived for 2 dayas at 20^{o}C and was completely inactivated by chlorine
Wu et al (37)	Quasi-experimental, non-clinical, no outcome measures	SARS-CoV-2 was found in wastewater
Wurtzer et al (38)	Quasi-experimental, non-clinical, no outcome measures	SARS-CoV-2 RNA was found in the wastewater in Paris but actual living virus was not studied.

Given the available data, baptism may be safely done with clean water. For serial baptisms in the same baptistry, the baptismal should be heated above 23^{o}C and treated with chlorine to decrease the risk of transmission of SARS-CoV-2/COVID-19. Although not specifically addressed in any study or published guideline, we recommend that the person performing the baptism wear a mask as social distance would not be possible, practice hand hygiene prior to the baptism, and defer to someone else if he/she has any symptoms compatible with SARS-CoV-2/COVID-19 infection.

Critical Question 4: Is it safe to have a choir performance/practice?
Guideline Recommendations

Level A Recommendation: none

Level B Recommendation: none

Level C Recommendation: Choir practices or performances that have a large number of participants, unmasked, in close proximity to one another for a prolonged period of time in an enclosed space with shared food, commonly touched items, and non-socially distanced interactions before and after may increase the risk of SARS-CoV-2/COVID-19 infection if one of the participants is infected. Therefore, choir rehearsals and performances should avoid these factors to decrease the risk of spreading SARS-CoV-2/COVID-19 infection.

Psalm 96:1-4 states, "Sing to the Lord a new song; sing to the Lord, all the earth. Sing to the Lord, praise his name; proclaim his salvation day after day. Declare his glory among the nations, his marvelous deeds among all peoples. For great is the Lord and most worthy of praise; he is to be feared above all gods." Likewise, Colossians 3:16 says, "Let the message of Christ dwell among you richly as you teach and admonish one another with all wisdom through psalms, hymns, and songs from the Spirit, singing to God with gratitude in your hearts." Since

the earliest of times, singing – chorale and congregational – has been a part of Judeao-Christian worship, binding generations together in the praise of God. However, choir practices and congregational singing have been implicated in the spread of SARS-CoV-2/COVID-19 infection.

Evidence: No Class I, II, or III evidence is available. The literature for this review was retrieved from a database search which included Medline, PubMed, Google Scholar, Google, CEBM, Cochrane Library, Oxford CEBM, CDC, NICE, NIH, and Medrixiv Preprints using the terms "choir" and "infection" or "COVID" or "SARS" or "coronavirus." Studies related to Mycobacterium tuberculosis were excluded due to different pathogen size and infectivity (R0).

There is only one medical report (Class IV evidence) in the literature of SARS-CoV-2/COVID-19 infection related to a choir performance or practice. In that case, 61 people with an average age of 69 participated in a 2-1/2 hour practice in an enclosed room without masks, sat mostly 6-10 inches apart in chairs but sometimes closer on benches, broke up into two sub-groups and used a smaller room, shared food, touched common items and congregated in close proximity while putting chairs away on March 10, 2020 (39). Subsequently, 32 people became ill with laboratory confirmed SARS-CoV-2/COVID-19 infection and 20 others developed symptoms that may have been due to SARS-CoV-2/COVID-19 infection, for an attack rate of at least 53.3%. Some of the choir members met before the rehearsal for dinner or coffee and it is unknown what contacts the choir members may have had with other people who could have been infected with SARS-CoV-2/COVID-19, but it is presumed that one choir member who had flu-like symptoms starting on March 7th and subsequently tested positive for SARS-CoV-2/COVID-19 infection was the index source patient. There were 2 choir members who did not attend either the March 3rd or 10th rehearsal but developed symptoms consistent with SARS-CoV-2/COVID-19 infection and 35 who did not attend either rehearsal and remained asymptomatic.

Similar outbreaks were reported in Amsterdam (40) and Berlin (41) when a large number of choir members, unmasked, in close proximity to one another rehearsed for a prolonged period of time in an enclosed space with shared food, commonly touched items, and non-socially distanced interactions before and after. Few details have been published making further assessment difficult, but 50 of 78 members of the Berlin Cathedral Choir contracted SARS-CoV-2/COVID-19 after rehearsing for a prolonged time in a room less than 1300 sq ft (42). In the Amsterdam case, 130 singers rehearsed in a small room without any hygiene measures even though 15 members were feeling ill, then performed the following day without any distancing, and 102 members ended up developing symptoms consistent with SARS-CoV-2/COVID-19 infection though not all tested positive for SARS-CoV-2/COVID-19 (43). Notably, hardly anyone in the audience subsequently became ill.

These three clusters have several factors in common—namely, large number of participants sang unmasked, in close proximity to one another for a prolonged period of time in an enclosed space with shared food and commonly touched items. *Therefore, choir rehearsals and performances should avoid these factors to decrease the risk of SARS-CoV-2/COVID-19 infection.*

Critical Question 5: When can congregational singing be done safely?

Guideline Recommendations

Level A Recommendation: none

Level B Recommendation: none

Level C Recommendation: Alternatives to congregational singing likely have the least risk for SARS-CoV-2/COVID-19 transmission. With the uncertainty regarding congregational singing, we recommend thoughtful consideration of alternatives. If congregational singing must be done due to specific faith convictions or practices, we recommend the following to decrease risk of SARS-CoV-2/COVID-19 transmission:

1. *Singing outdoors rather than in an enclosed space when possible,*
2. *Maintaining a minimum distance of 6 feet between congregants,* ***and***
3. *Wearing masks while singing,* ***and***
4. *Singing in a quiet, subdued voice.*

The apostle Paul admonishes, "Do not get drunk on wine, which leads to debauchery. Instead, be filled with the Spirit, speaking to one another with psalms, hymns, and songs from the Spirit. Sing and make music from your heart to the Lord, always giving thanks to God the Father for everything, in the name of our Lord Jesus Christ." (Ephesians 5:18-20). The early church was characterized by its congregational singing, finding it to be both a form of worship and teaching. However, there has been concern that congregational singing may be associated with the spread of SARS-CoV-2/COVID-19 infection (17).

Evidence: No Class I, II, or III evidence is available. No peer reviewed studies could be found related to congregational singing and the spread of SARS-CoV-2/COVID-19 infection. The literature for this review was retrieved from a database search which included Medline, PubMed, Google Scholar, Google, CEBM, Cochrane Library, Oxford CEBM, CDC, NICE, NIH, and Medrixiv Preprints using the terms "singing" and "aerosols" and "infection" or "COVID" or "SARS" or "coronavirus."

There are several non-peer reviewed studies that have looked at factors related to singing and aerosol spread in SARS-CoV-2/COVID-19, but all of them involved small numbers and professional musicians, which may not reflect conditions in most churches or houses of worship. Table 3 summarizes the findings of these studies.

Table 3. Class IV evidence regarding singing and aerosols with SARS-CoV-2/COVID-19

Source	Country	Measurement	Findings
Becher, Gena, Volker (44)	Germany	Background Oriented Schlieren visualization	No spread of air past 100 cm/3.3 feet
Kahler, Hain (45)	Germany	Laser illumination of aerosols	None detected past 1.5 m/4.9 feet
Murbe et al (46)	Germany	Particle Count Measurement	Singers had higher particle emission rates than just

			speaking, distance measurements were not done
Ono, Okuda (47)	Japan	Not specified	Detected up to 5.9 feet
Spahn, Richter (48)	Germany	Air speed Sensors	None detected at 2 m/6.6 feet
Sterz (49)	Austria	Photo-documentation	None detected past 1.5 m/4.9 feet; spread significantly decreased with mask wearing

These studies suggest that singing may be safe if singers are appropriately distanced. However, there are several significant factors that must be considered when evaluating these non-peer reviewed studies. The first is the lack of a singular, universally accepted gold standard for detecting aerosolized SARS-CoV-2/COVID-19. Second, the studies listed in table 3 claimed to measure "aerosols" but were not likely to accurately detect the 5 µm particles considered "aerosols" in the medical literature (50). While they did assess for "spray," "air movement", and/or "particle emission," these markers of aerosolization are not actual measurements of the $\leq$5 µm aerosol particles of current debate in the medical literature. Third, these studies involved limited numbers in controlled environments and may not apply to larger groups of singers. Fourth, these studies involved professional singers for whom singing "dynamics" and "physiology" may differ from those of non-trained, lay singers. Fifth, these studies did not actually assess for SARS-CoV-2/COVID-19. Finally, there was no clinical assessment or outcomes measured.

Asadi et al (51) has been quoted in numerous reports that discuss SARS-CoV-2/COVID-19 aerosolization but did not specifically study singing or SARS-CoV-2/COVID-19. They used an aerodynamic particle sizer in a laminar flow hood to characterize the numbers and size distribution of particles emitted by healthy volunteers performing various vocalizations and breathing activities. Although these conditions may not accurately represent conditions for speech or singing in a normal or church environment, they found that particle emission rate during speech was linearly correlated with loudness of vocalization, but that particle size distribution was not. They also had two other important findings. The first was the possibility of "superemitters" who expel more particles/ cm^3 for unknown reasons. The second was the lack of a significant difference between breathing and speech that was either quiet or intermediately loud. Thus, they write, "A second key epidemiological implication of our results is that simply talking in a loud voice would increase the rate at which an infected individual releases pathogen-laden particles into the air, which in turn would increase the probability of transmission to susceptible individuals nearby. For example, an airborne infectious disease might spread more efficiently in a school cafeteria than a library, or in a noisy hospital waiting room than a quiet ward."

A review by Anderson et al (50) noted that there is concern that SARS-CoV-2/COVID-19 may be spread by aerosols which appear across all types of activity including breathing, talking, and coughing. Thus, a recent review of the existing literature used the term "'airborne-lite' transmission" (52) since there appears to spread of SARS-CoV-2/COVID-19 through aerosols that do not exhibit the same "airborne" transmission of other pathogens such as tuberculosis and chicken pox. Likewise, a recent commentary on the matter used the term "microdroplets" to describe this observed phenomenon of airborne-like transmission of SARS-CoV-2/COVID-19 (53). Indeed, a recent commentary noted that the traditional differentiation between "droplet" and "airborne" precautions is likely artificial as they more likely lie on a spectrum of transmissible infections with some overlap (54). As previously noted, SARS-CoV-2/COVID-19 transmission has been much lower than would be expected by traditional airborne aerosols (55), which may explain why the World Health Organization continues to consider airborne transmission to be limited (56).

Although California Department of Public Health guidelines recommend discontinuing "singing (in rehearsals, services, etc.), chanting, and other practices and performances where there is increased likelihood for transmission from contaminated exhaled droplets" (57), they do not specify what is meant by "where there is increased likelihood for transmission from contaminated exhaled droplets" and no references are given to allow for examination of applicable evidence. These guidelines have not been universally accepted in other states or by other agencies, further adding to the difficulty of assessing their applicability.

Although the evidence is sparse and of uncertain applicability, given the totality of the available evidence, alternatives to congregational singing (e.g., pre-recorded singing and music, a microphoned soloist in another room, a microphoned choir with members in different rooms, etc.) likely have the least risk for SARS-CoV-2/COVID-19 transmission. With the uncertainty regarding congregational singing, we recommend thoughtful consideration of alternatives. If congregational singing must be done due to specific faith convictions or practices, we recommend the following to decrease risk of SARS-CoV-2/COVID-19 transmission:

1. *Singing outdoors rather than in an enclosed space when possible,*
2. *Maintaining a minimum distance of 6 feet between congregants,* ***and***
3. *Wearing masks while singing,* ***and***
4. *Singing in a quiet, subdued voice.*

Further considerations such as singing shorter songs or singing at the end of service may also further reduce the risk of SARS-CoV-2/COVID-19 transmission. A recent pre-print review on the matter of singing and SARS-CoV-2/COVID-19 makes similar recommendations and offers a few additional recommendations that may be useful for churches (58)

Critical Question 6: Is it safe to have wind, percussion, and/or string instrumental accompaniment in worship?

Guideline Recommendations

Level A Recommendation: none

Level B Recommendation: none

Level C Recommendation: The use of instrumental accompaniment in worship does not appear to increase the risk of spreading SARS-CoV-2/COVID-19 infection when appropriate distancing and hygiene measures can be followed.

Psalm 33:1-3 states, "Sing joyfully to the Lord, you righteous; it is fitting for the upright to praise him. Praise the Lord with the harp; make music to him on the ten-stringed lyre. Sing to him a new song; play skillfully, and shout for joy." Dating back to ancient Israel, musical instruments have been used to praise God. Although some Christian traditions do not use musical instruments in worship (e.g., historic Mennonite, Churches of Christ, Orthodox), many Christian traditions have a rich heritage of using instrumental music in worship services. However, due to the forceful blowing required for using some instruments, they may be a source of spreading SARS-CoV-2/COVID-19 infection.

Evidence: No Class I, II, or III evidence is available. No peer reviewed studies could be found related to playing musical instruments and the spread of SARS-CoV-2/COVID-19 infection. The literature for this review was retrieved from a database search which included Medline, PubMed, Google Scholar, Google, CEBM, Cochrane Library, Oxford CEBM, CDC, NICE, NIH, and Medrixiv Preprints using the terms "instruments" or "music" and "infection" or "COVID" or "SARS" or "coronavirus."

There are several non-peer reviewed studies that have looked at factors related to aerosol spread with various instruments but all of them involved small numbers and professional musicians, which may not reflect conditions in most churches or houses of worship. Table 4 summarizes the findings of these studies. All of them appear to suggest that musical instruments could be used safely in worship as long as appropriate distance is maintained and face masks are worn whenever possible. These studies share the same limitations as those listed in Table 3.

Table 4. Class IV evidence regarding musical instruments and aerosols with SARS-CoV-2/COVID-19

Source	Country	Measurement	Findings
Becher, Gena, Volker (44)	Germany	Background Oriented Schlieren visualization	Various instruments produced different spread of air, None detected past 80 cm/2.6 feet
Froschaeuer, Sterz (59)	Austria	Photo-documentation	Wind and string instruments produced different spread, none past 80 cm/2.6 feet
Kahler, Hain (45)	Germany	Laser illumination of aerosols	Wind instruments produced more

			aerosol than brass instruments, but not past 1.5m/4.9 feet
Ono, Okuda (47)	Japan	Not specified	Wind instruments produced less aerosol than a soloist singing, but less than 1 m/3.3 feet
Spahn, Richter (48)	Germany	Air speed Sensors	None detected at 2 m/6.6 feet
Sterz (49)	Austria	Photo-documentation	None detected past 1.5 m/4.9 feet

Although the evidence is sparse and of uncertain applicability, given the totality of the available evidence, the use of instrumental accompaniment in worship does not appear to increase the risk of spreading SARS-CoV-2/COVID-19 infection when appropriate distancing and hygiene measures can be followed. However, of all the instruments, the flute may pose more risk than others.

Critical Question 7: What general measures should be considered for all worship gatherings?

Level A Recommendation: none

Level B Recommendation: Social distance, wearing of masks, availability of hand sanitize, and frequent hand washing should be done

Level C Recommendation: Consideration should be given to vulnerable populations in the congregation as defined by the CDC.

Evidence: N No Class I evidence is available for mask wearing as a means of mitigating transmission of SARS-CoV-2/COVID-19, however Class II and III evidence is available. The literature review on masks was not exhaustive but focused on three specific areas: (1) laboratory tests of different fabrics done in 2020 with specific consideration for SARS-CoV-2/COVID-19, (2) systematic reviews of community mask use to prevents SARS-CoV-2/COVID-19 transmission, and (3) articles regarding community mask use with SARS-CoV-2/COVID-19 infection as an outcome in 2020.

Table 5 summarizes these studies. In total, these studies demonstrate several key findings. First, the use of cloth masks—particularly 100% cotton with a high yarn count, multilayer fabrics, or hybrid fabrics--provided significant filtration of small particles. Cloth masks also decreased the spread of bacteria from a spray mimicking sneezing as well as decreased the ability of aerosolize NaCl to pass through the fabric. While these measures were not the same as testing for SARS-CoV-2/COVID-19, they were taken as acceptable surrogate markers for possible SARS-CoV-2/COVID-19 spread. Second, the use of face masks was associated with fewer cases of SARS-CoV-2/COVID-19 per million population in Hong Kong vs. other areas with SARS-CoV-2/COVID-19 outbreaks. While multiple confounding factors could be responsible for this difference including community seroprevalence, for example, similar findings of the

protective effects of masks were found in Wuhan, China, and Italy and New York City. Likewise, in a meta-analysis of 44 studies, mask use was associated with a decreased risk of respiratory infections (though the effect was greatest for N-95 masks, the finding persisted for other masks as well). Two other reviews identified that masks prevented infections with SARS-CoV-2/CoV-1, which may have implications for SARS-CoV-2/COVID-19. Furthermore, none of these studies demonstrated harm relative to SARS-CoV-2/COVID-19 infection or transmission from community mask use. *Thus, face masks should be used during worship gatherings to decrease the risk of SARS-CoV-2/COVID-19 transmission.*

Table 5. Class II/III evidence regarding mask effectiveness in preventing SARS-CoV-2/COVID-19 transmission.

Source	Country	Design	Measurement	Findings
Cheng et al (60)	China (Hong Kong)	Retrospective, cohort study (Class III)	Incidence of SARS-CoV-2 in first 100 days	Incidence in first 100 days in Hong Kong with community-wide masking was 129.0 per million population. Incidence for similar countries that did not have community wide masking ranged from 259.8 to 2983.2 per million population.
Chou et al (61)	Multiple	Systematic Review (Class II)	Rapid, Living Review	There is evidence of low strength that masks (type not specified) were beneficial at preventing SARS-CoV-1 in the community. No articles examining SARS-CoV-2 and mask use in the community were found.
Chu et al (62)	Multiple	Systematic Review and Meta-analysis (Class II)	Frequentist and Bayesian meta-analyses and random-effects metaregressions	Risk of infection may be significantly reduced with mask use (n=2647; aOR 0.15, 95% CI 0.07 to 0.34)
Konda et al (63)	USA	Quasi-Experimental, non-clinical	NaCl aerosol particle measurements upstream and downstream of various fabrics.	Hybrid fabrics showed filtration efficiencies >80% for particles <300 nm and >90% for particles >300 nm. Multiple layers improved filtration efficiencies. For particles

			(Note: Did not test SARS-CoV-2)	<300 nm, surgical masks provide particle exclusion >60%. For particles above 300 nm, exclusion is close to 100%.
Liang et al. (64)	Multiple	Systematic Review and Meta-analysis (Class II)	Newcastle-Ottawa Scale, calculations of heterogeneity, fixed effects and random effects.	Masks had a protective affect against SARS-CoV-1 (OR=0.26). There were no articles on the effect of masks in the community in preventing infection with SARS-CoV-2.
Rodriguez-Palacios et al (65)	USA	Quasi-Experimental, non-clinical	Bacterial-suspension spray (mimicking a sneeze) onto various fabrics. (Note: Did not test SARS-CoV-2)	Bacteria were dispersed <30 cm for single layered textiles and <10 cm for double layered textiles. Bacteria were dispersed <10 cm for surgical masks.
Zangmeister et al (66)	USA	Quasi-Experimental, non-clinical	NaCl aerosol particle measurements upstream and downstream of various fabrics. (Note: Did not test SARS-CoV-2)	Top performing cloth fabrics were woven 100% cotton with high to moderate yarn counts and woven synthetics with moderate yarn counts. Filtration efficiency increased with the number of layers. Surgical masks had a minimum filtration efficiency FE_{min} of 30.5%.
Zhang et al (67)	China, Italy, and US	Retrospective cohort study (Class III)	Used linear correlation between date and number of infections to make projections of infections prevented.	Face coverings in Wuhan, Italy, and New York City were the most important mitigation measure that prevented new SARS-CoV-2 infections.

Social Distancing: In the most comprehensive systematic review and meta-analysis to date (62), Chu et al found that physical distancing of 1 meter or more compared with less than 1 meter was associated with a significant reduction in risk of infection (n=25,697 patients, pooled adjusted odds ratio [aOR] 0.18, 95% CI 0.09 to 0.38) and the risk of infection decreased as distance increased [RR]=2.02 per m. There was moderate certainty for this estimate. In

addition, the absolute risk of infection at 2m was <1% for those at intermediate baseline risk for infection and less than 2% for those at high baseline risk for infection. *Thus, we recommend maintaining social distance of at least 6 feet between households for those gathering for worship.*

Lastly, churches will need to consider that people in the following categories may need special consideration. The Centers for Disease Control (68) has identified older adults, as well as people of any age with the following conditions as being at higher risk for developing severe illness from SARS-CoV-2/COVID-19 infection:

- Chronic Kidney Disease
- Chronic Obstructive Pulmonary Disease (COPD)
- Immunocompromised state (weakened immune system) from solid organ transplant
- Obesity (body mass index [BMI] of 30 or higher
- Serious heart conditions, such as heart failure, coronary artery disease, or cardiomyopathies
- Sickle cell disease
- Type 2 diabetes mellitus
- Children who are medically complex—neurologic, genetic, metabolic conditions, or who have congenital heart disease

People with the following conditions may also be at increased risk:

- Moderate-to-severe asthma
- Cerebrovascular disease (affects blood vessels and blood supply to the brain)
- Cystic fibrosis
- Hypertension or high blood pressure
- Immunocompromised state (weakened immune system)
- Neurologic conditions, such as dementia
- Liver disease
- Pregnancy
- Pulmonary fibrosis
- Smoking
- Thalassemia
- Type 1 diabetes mellitus

Churches should consider how best to serve these members who may be at risk for worse outcomes if they got infected with SARS-CoV-2/COVID-19. In addition to recommending those members attend on-line if possible, churches could consider a separate service with added precautions (e.g., greater distance, addition of face shield or eye wear in addition to use of masks, alternatives to congregational singing, etc.) for the vulnerable.

Additional consideration

We are aware that in different areas, churches may not be allowed to practice even according to these evidence-based guidelines and recommendations. How should the church act in those

circumstances, when it cannot even adopt these practices? Churches should not abandon the core tenets of their faith and will have to prayerfully consider how, given local restrictions, they can still "render to Caesar what is Caesar's, and render to God what is God's." Our intent is to help churches worship God in a safe way, knowing that no gathering is completely risk-free. As has been shown with prior outbreaks (e.g., SARS, swine flu, etc.), gathering for any reason will have some risk and each community of faith will have to determine for itself how best to worship God in light of local regulations, existing evidence, and the guidance of Scripture. Given the clear benefits of gathering to worship God, we believe that these guidelines do provide a structure for gathering in the safest manner possible.

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